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NOTES ON THE LIFE HISTORY OF *SCAPHIOPUS COUCHII* BAIRD.

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The geographical range of Couch's Spadefoot (*Scaphiopus couchii* Baird) is, even at this late date, very imperfectly known. In Texas I have traced it north to within fifty miles of Fort Worth. It is an abundant species in the coast region, from Refugio south to the mouth of the Rio Grande River, but it does not appear to range east of the 96th parallel. It inhabits the entire Rio Grande Valley from Brownsville to El Paso. It is as common in central Texas (Waco and Burnet) as it is in the southern portion, and this leads me to believe that its Texas range is far more extensive than is at present known. The only authentic record I have for the Territory of New Mexico is based on a single example from the White Mountains, sent me for identification by Messrs. Townsend and Barber. In Mexico it is found along the northeastern boundary, in the States of Chihuahua, Coahuila, Nuevo Leon, and Tamaulipas, and in the Cape region of Lower California. Definite localities for central and western Mexico are lacking. This leaves an extensive range of country from which our museums possess no specimens, but it is reasonable to suppose that the animal is found as far south as Durango and Victoria.

As can be seen by the foregoing, *Scaphiopus couchii* is found in the more elevated districts as well as in the low-lands, and to judge from the altitudes of recorded localities there is a possibility of its extending from the Lower Sonoran zone into the edge of the Upper Sonoran in western Texas and southern New Mexico. At Brownsville, Texas, the altitude is only about 36 feet, while the White Mountain, New Mexico, specimen was collected at approximately 5200 feet. The altitude of Waco, Texas, is about 410 feet, Burnet, 1300 feet, and El Paso, 3700 feet. In southeastern Texas (Refugio) its range overlaps that of the eastern spadefoot (*Scaphiopus holbrookii* Harlan) and in the western part of the State (El Paso) it has been found breeding in company with *S. hammondii* Baird.

At Waco I have found the following species of Salientia in pools occupied by *Scaphiopus couchii: Bufo compactilis* Wieg., *Bufo punctatus* B. & G., *Bufo valliceps* Wieg., *Bufo debilis* Girard, *Bufo americanus* Le Conte (var.), *Engystoma carolinense* Holbrook. The first four of these are typical Sonoran species; the last two are Austroriparian forms.

In the following pages the descriptions are based on specimens from Waco, Texas, and the northern part of the State of Chihuahua, Mexico. It was not possible to examine fresh material from Lower California, and I am therefore unable to make comparisons between examples from the northern and southern limits of its range. The specimens from Miraflores and San Jose del Cabo in the collection of the California Academy of Sciences were destroyed in the great fire, while the La Paz and Cape St. Lucas specimens in the United States National Museum have been in spirits for many years and are therefore worthless for purposes of comparison, when color characteristics are taken into consideration. In living specimens the coloration is very variable, and a series will show several very distinct types. The general color of the upper parts, in all specimens examined by me, was of some shade of green.

Life Coloration of Adults.

TYPE A.—Above, uniformly light yellowish-green to dark green with traces of darker markings in the dorsal region, but presenting no distinct pattern. Under parts, white. One specimen was dark ochre-yellow above with darker areas on the back. Under parts white, excepting on the belly, which was rusty yellow. Inner surfaces of limbs, light rust color.

TYPE B.—General coloration as in A, but there are numerous small black spots scattered all over the dorsal area. In specimens preserved in spirits these spots persist after the bright colors have faded out.

TYPE C.—This is the banded or cross-barred type described by Cope. I here repeat his description: "Color above, yellowish, with irregular brown bands which converge between and behind the orbits; others diverge on the flanks, beginning at the orbits; one from same point to hip, and one to canthus rostralis. There is a confluence of dorsal bands near the sacrum. A light band on outer face of tarsus and toe." *

In life examples of Type A present the appearance of plainly colored, unmarked animals. The markings in the third type, however, are very conspicuous in both living and preserved specimens. In my report on the reptiles of McLennan County,† Texas, through a careless reading of the manuscript, I am made to say that the majority of the cross-barred examples are *males*, when I intended to say *females*. During the months of April and May of this year I collected 87 adult examples of this species. Forty-two of these were females, all cross-barred. Of the forty-five males, thirty-eight were of Type A, the others were of Type B.

Descriptions of Young Specimens.

EXAMPLE A.—Length 16 mm. Tail not fully absorbed. Above, dark brown, appearing blackish when placed in water. Under parts, dirty white. Spur fully formed, blackish-brown in color. Locality, Waco, Texas. Captured while endeavoring to burrow in the soft earth a short distance from the breeding pool.

EXAMPLES B AND C.—Length, 18 and 19 mm. Above, dark brown, lighter on the sides and limbs. Under parts, dirty white. Tail fully absorbed. Localities, Waco, Texas, and Lake Guzman, Chihuahua.

EXAMPLE D.—Length, 26 mm. Light yellowish-green above with scattered blackish dots in the dorsal region. Under parts, white. Locality, Sabinal, Chihuahua.

EXAMPLES E TO H, INCLUSIVE.—Yellow-green with dark crossbars. Markings darker and more distinctly defined than in older examples. Length, 28 to 32 mm. These specimens were captured in the damp grass a couple of yards from a pool in which a number of adults were breeding. Locality, Waco, Texas.

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* The Batrachia of North America.

† Proc. Biol. Soc. Wash., XXI, 1908, p. 80.

Breeding Habits.—The clasp of the male is inguinal as is usual in the family (*Pelobatidae*). About three hours is usually required for the laying of the complement of from 350 to 500 eggs, and during this time there are from four to eight periods of sexual activity. A captive pair remained in copula for nearly eight hours but this is unusual.

The eggs are in strings, in double and even triple rows. These strings range from 1½ to 2½ inches in length, and the number of eggs in a string varies from 45 to 125. The pigmented portion of the egg is black and the yolk porcelain white, while the surrounding jelly mass is almost colorless. The diameter is about one-sixteenth of an inch. The largest number deposited by one female was 528; the smallest, 343.

The eggs are attached to grass, weeds and rootlets, in from 3 to 6 inches of water. They are very bouyant and readily float on the surface. I made a careful count of the number of eggs in the eleven strings comprised in two full complements, and the result is as follows:

								Total.
Lot A	76	78	79	110				343
Lot B	81	124	66	49	54	86	45	505

The eggs hatch in from eight to ten days. The newly hatched larvae are tender and rather inactive, but their growth is exceedingly rapid, and within the course of a very few days they are swimming freely in the shallower portions of the pond. In form the week-old tadpole is short and plump. The general color is blackish-brown, lighter on the belly and tail. The latter, which is unusually slender, is sometimes more or less blotched and spotted with darker shades.

On the 12th or 13th day after hatching the limbs begin to appear, and from this time until they are ready to leave the water the tadpoles are usually found in shallow water close in to the edge of the bank. A dip-net will bring up scores of them in one sweep. On the 19th or 20th day the little animals leave the water with their tails still in evidence. They are now about 14 or 15 mm. in length, and the short tail is probably absorbed within the next three or four days. It is a difficult matter to be certain of this, however, as they commence to burrow within a few hours after leaving the water.

The coloration is now essentially that of Example B (see the descriptions of young specimens), and it is probably several weeks before they assume that of the adult. The young specimens described as Examples E to H were collected in July, 1898, and by a reference to my notes I find that *Scaphiopus* were breeding in May of that year. After making a proper allowance for the time necessary for them to go through their transformation we can be reasonably certain that these specimens were about four or five weeks old.

The most of the above observations were made at a series of temporary ponds located on the flats west of Waco. They were commenced during a spell of rainy weather lasting for several days, and all of the eggs were not deposited on the same night. This will account for the difference in the time of hatching.

Voice.—The cry of the male is a loud, resonant "yē-ŏw" repeated at intervals; that of the female, a short, grunting "ŏw" uttered several times with shorter intermissions. The vocal vesicle of the male is unusually large, expanding at the throat, sides and breast. Fully distended it is about three times the size of the head, and as seen rising and falling on a level with the surface of the water, when the animal utters its cry, it presents the appearance of a small silvery-white bladder.

The voice of this species is much louder than that of any of our other toads and frogs, and many persons claim that it is almost impossible for them to sleep while the animals are howling in an adjoining lot. In confinement the males utter low, plaintive cries quite different from their usual loud notes.

Food.—The stomachs of several examples collected near electric lights contained the remains of various species of beetles, flies and moths. Specimens thus captured are never found out in the open, exposed to the full glare of the light, but are usually discovered lurking under cover of grass and weeds. It would seem as though they were lying in wait for the insects that succeed in escaping the other species of toads which usually congregate in such places. A florist who has placed a number of *Scaphiopus* in his flower pit informs me that their diet consists largely of earthworms.

General Notes.—This species is not as retiring as its eastern relative, *Scaphiopus holbrookii*. In fact its general habits show a resemblance to those of the night-prowling toads such as *Bufo debilis* Girard and *B. compactilis* Wieg.

In former years I have known specimens of Couch's spadefoot to come out of their burrows on rainy days as early as three o'clock in the afternoon, and during the present year I captured examples as late as ten o'clock in the morning. After the breeding season is over it is only occasionally that one will run across a specimen out of its burrow.

Judging from the published accounts of the habitation of *Scaphiopus holbrookii*, I should say that the burrow of our species was similar in every respect. On account of its abundance it is not an uncommon occurrence for a gardener to unearth four or five examples during the course of a single morning's work. The truck gardeners know the animal as the "green burrowing-toad."

In her excellent account of *Scaphiopus holbrookii* Miss Dickerson makes the following remarks: "After the eggs are laid the spadefoot toads disappear entirely, leaving no trace of their hiding place. In fact it is not known whether they burrow in low land where temporary pools are likely to form, or whether they go a considerable distance into higher land before they burrow. At any rate these facts are well authenticated: they disappear with never a stray one behind, and they may not reappear again in the same locality for years." *

In reply to these remarks I can state with certainty that our spadefoot *does* burrow in the neighborhood of its breeding places. I have on several occasions unearthed both adult and young specimens within a few yards of a pool in which hundreds of tadpoles had undergone their transformation.

Our species appears in numbers as regularly as the year comes around, and my note book shows an unbroken record for the period from 1895 to 1908. In some years the animals seem more abundant than in others.

I have known them to go in the water as early as the tenth of April, but in 1905 they were unable to find suitable breeding places until the latter part of July. As a usual thing, however, the majority breed during the month of May.

This year I found eggs at three different times within a period of seven weeks, which proves conclusively to my mind that all of our spadefoot toads do not breed at the same time.

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* The Frog Book, New York, 1906, pp. 55-56.

When the animals are in the water they swim in short spurts. If the pool is deep they disappear beneath the surface at the slightest alarm, but if it is shallow they flounder rather helplessly.

Early one rainy morning in May I captured a male spadefoot in my front yard, and hearing the cries of others in the adjoining lots I decided to spend a couple of hours in investigating their breeding habits. I dressed to suit the occasion and after providing myself with a perforated fish-bucket and a dip-net, crossed over into the next yard and took up my station in an old, dismantled frame building. The water was from four to six inches deep and only the tops of the taller weeds and grass stalks were above the surface. I remained perfectly quiet for several minutes, keeping my eyes riveted on several grass patches near at hand. In a short space of time my patience was rewarded by the appearance of a yellowish-green head with unusually prominent golden eyes. The spadefoot swam clumsily in the direction of a nearby grass clump and when he had reached it he drew himself partly out of the water and gave vent to a long-drawn "yē-ŏw." His cry acted as a signal, for immediately *Scaphiopus* in all portions of the yard responded lustily and the chorus was almost deafening. While my male was giving vent to his cry it seemed as though the air in his pouch made him shaky and he had trouble in keeping his equilibrium, rolling from side to side and treading water rather aimlessly.

A female began to grunt, and by the time I could slip around to a point of vantage the male had her in his embrace. I slipped back to cover, and as the pair were only about two yards from the building I could watch them through a crack in the wall.

In about twenty-five minutes the animals went through some peculiar contortions, indicating that they were in the act of laying the first batch of eggs and I decided that it was time to transfer them to my bucket. Attached to a grass blade was the first emission of eggs, 80 in number, arranged in a double string. While the female was depositing these eggs she grasped the grass-stalk with her fore-feet and drew the male above the surface of the water. Prior to the emission only his head and shoulders were visible.

The male is very ardent in his attentions, and if forcibly separated from the female utters low plaintive cries and grasps aimlessly at any object that is presented to him. I kept a mated pair and four extra males confined in a fish bucket for a short time and was compelled to *separate them*, as the latter would persist in grasping the hind legs of the other male and it was a difficult matter to get them to relinquish their hold.

The number of specimens that make their appearance within the limits of the city of Waco is simply enormous. In a vacant lot across the street from my house I captured twenty-two examples between twilight and dark, and to judge from the sounds made by those that were left it seemed as though the number was scarcely diminished. In a horse-lot across the alley from this place there must have been at least a couple of dozen more. In a section of the city twelve blocks long by three blocks wide there are at least twenty-five places where spadefoot toads congregate in numbers. The next morning after an unusually heavy rain hundreds of strings of eggs will be found in these places. None of these eggs ever hatch but are dried up in the course of the next twenty-four hours.

In East Waco and on the flats west of the city, however, there are low places where the water stands for a couple of months or more and in these ponds young spadefoot toads are reared by the thousands.

In concluding this paper I desire to thank Dr. Leonard Stejneger, United States National Museum; Dr. John Van Demburgh, California Academy of Sciences, and Dr. Seth Eugene Meek, Field Museum of Natural History, for their kindness in furnishing me with lists of the localities from which their respective institutions have received specimens of *Scaphiopus couchii*.

All of the other notes are original and all descriptions of young and adult specimens are based on examples preserved in the Museum of Baylor University.

There is a wide field open to the student of Batrachology, and as a large per cent of our most interesting forms inhabit sections of the country far removed from the great museums and laboratories it remains for local observers to supply what information they can in regard to the life histories of those forms of which we as yet know little or nothing.